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[Please stand by for real time captions.]--

Good afternoon. We are entering into our second session of the asteroid grand challenge anniversary seminar series. We started with a great conversation around asteroid hunting and what it would take for amateurs to contribute. We are now shifting to using asteroid data creatively. Some of the things that I heard in the previous conversation, I would like to pull in because I feel we have a good group for this next session to explore visualization and data processing in ways we can engage people more roughly. In order -- more broadly. I will go around and ask everyone to introduce themselves, name, affiliation and a couple sentences and a couple minutes around what you do and what your experience is to bring you into this conversation so the others in the group understand what you have been up to and those tuning in can understand as well. Collectively we would like to have a conversation to figure out how to do this together. Another thing I ask you to share, I did deep impact or Armageddon with the last group, Star Wars, Star Trek and where you fall on that line. Let's go with Amelia who is here with me.

Hello I am Amelia and a UX designer with a firm with Sampras so -- San Francisco firm called Star Wars.

Was a -- who is a?

-- Jose Him.

I wear very many hats and one is to interact with cool people outside [Indiscernible] community and as far as Star Wars, Star Trek because I grew up in the 80s but I think I would have to go with Star Wars.

Gary.

I will have to go with Star Trek because our [Indiscernible] is called four point .

There is always one.

Can you give us a little bit of background on yourself and your perspective on this conversation.

I have been in astronomy for four years unless 15 years I have been turning in [Indiscernible] observations a little about [Indiscernible] observations of those 15 years and a member of the North East Kansas [Indiscernible] league it's called [Indiscernible] because the [Indiscernible] is too long and I found a few hundred asteroids and they have three meals including -- three [Indiscernible] and that was fun. I

also found found a common in 1999 called [Indiscernible]. That is about where I am at.

That is quite a list.

Thank you.

Mike.

Mike are you on the telecom line?

We cannot hear you.

Mike is not on the phone line.

Still nothing.

Is anyone else hearing anything?

No.

Him [Indiscernible] can you hear?

He will have to dial in.

Let's go to Felix.

The astronomers did a much better job.

Let's go to John.

I used to be an excerpt physicist and work done [Indiscernible - heavy accent]

[Indiscernible]

[Indiscernible - echoing]

Who --

For those on the telecom line, please mute your audio.

[Indiscernible - heavy accent] [Indiscernible - echoing]

And can we get three answers?

I will let you decide.

I will have to go Star Trek.

I should have not asked.

Mike I see you back.

Yes can you hear me on the phone?

I am a software engineer and I volunteer as co-organization --: is thereups and were the New York City local site and I'm also a community organizer with organization called up start of bus were we are 1000% global network of entrepreneurs and the organization has the goal of empowering the people who can disrupt the status quo to critically -- higher quality of life for everyone. Jason from Jan last year for brainstorming community involvement at the first [Indiscernible] and I'm happy to be back again .

Welcome back.

Star Trek.

I am Felix and paste working at the user with an area briefly little bit above overlap and moved on to Google for all of it. And I actually went back worked further and help develop slow launch program which fell out initially as well and then asteroid nerd. Ways to work with [Indiscernible] .

And Star Wars.

Let's go to Etan.

He will private message you. Let's go to Herb.

Hello from Austria, I've been involved with asteroids and [Indiscernible] for maybe 25 years or so and at some point in time with a game changer we move from films to CCD and we just -- we determined there's no software available to assure other positions. And I

was [Indiscernible] back at that time so I set down at my computer and drove the software or myself basically and much to my surprise at that time a lot of other people were interested and 20 years [Indiscernible]. Regarding Star Trek or Star Wars I have to admit I have not seen any of the Star Wars movies but I saw all Star Trek so definitely Star Trek.

That is a bold statement.

Are we back with Etan?

This is the first time I held a phone to my had in a few years. I will start with my favorite sci-fi, hands down it would be Star Trek. I watched it since I was a kid and I do like Star Wars but Star Trek once in my opinion. I am head of design at [Indiscernible] or head of UX design and the hybrid background of software engineering and transition into design as Felix mentioned I used to work at E user and colleagues with Felix and [Indiscernible] who is somewhere in there and also been friends with Jeff [Indiscernible] who runs further by design . I've been interested in astronomy and I can't say that I am even going to qualify as an amateur astronomer the looks of people who are on this call for Mac I am very --. I am a very data oriented designer so I think I can have some impact on in terms of dealing with huge amounts of asteroid data and performing analysis. In the community aspect of it.

What a group. We have a powerhouse here and I think it's perfectly time to follow the session that we just had for those of you who were able to tune in. One of the themes coming out was how do we be able to tell the story better whether it is better video communication or making the data more user-friendly or accessible. The first question we kicked around to get us started that is what can be done with asteroid data? Maybe two specific to jump in but I thought I would throw it out to JosÃ© who has been working on this issue for quite some time and is our minor planet Center representative. Do want to kick us off with thoughts?

I would like to say that I don't know. Let me qualify that, I think the power of were trying to do is to open up the asteroid data to people who are not astronomers but are used to dealing with data and probably a lot more data than what we have. And using it in an efficient and beautiful way for whatever it is they use data for. I can think of a few things, they are mostly scientific but I think people that are outside of astronomy can think about multiple useful stuff that will appeal to more than the 20 will that might remind -- one of my papers. I think of the recruitment quite a collector and live to astronomers that are here, myself and Gary but I think I am here [Indiscernible] ideas rather than trying to much or director conversation or Mac the one thing I will say is I do see the data being useful for two purposes. Someone is amateur or professional astronomers are interested in knowing what's going to be visible when and where and how to observe it and the other different use is for the general public which makes up most of the G.I. that were hoping to look at our data. We want to know, I'm not sure but the question I get is [Indiscernible] we need to answer that first and after that everything to do with the data

to show how many asteroids are close to us and passing by and with the population looks like, and letting people play with the data in real-time I have no idea. I think the sky is the limit and them is a stuff done with it online and I'm hoping the same stuff can be done with asteroid data.

Do you think there's also the idea of awareness, do people want to be aware that this is not necessarily a problem but is could be a problem or are we trying to create a, a world we could be hit at any time?

I would say part of the reason we announce the grand challenge, NASA is working on this problem but it was to do that very thing, great awareness this is an issue and at the same time do so in a way that enables people to participate. This is a global problem that potentially affects everyone and is there a way of engaging people in telling the story so that not only are the interested but we set up pathways for them to participate. That really is the heart of it because the challenge statement is to final asteroid threats and to know what to do about them and we are attempting and open innovation approach to enable people to help us with that. How do we engage them and utilize the data that we do have in a way that is enticing. It's one of the issues that we would like to explore.

[Indiscernible - echoing] we were all surprised and how ingestible [Indiscernible] data was as we basically came in with no background knowledge about asteroids at all [Indiscernible] and kick ideas around at lunchtime on Saturday. [Indiscernible] using real data with correct relative distances [Indiscernible] whether relative velocity and [Indiscernible] and compositions. And we also [Indiscernible] and had dinner that day and I was astonished how successful the data was in by the way thank you so much. [Indiscernible] and have it accessible and it was interesting thing . [Indiscernible] and use what they learn to build that [Indiscernible] . And then we took [Indiscernible] to get us hooked up with [Indiscernible] which came around a few weeks after [Indiscernible] and as we went to downtown York -- New York and we spent all afternoon showing [Indiscernible] asteroids and the games we played the whole afternoon. [Indiscernible - heavy accent]

I will jump in and say I felt particularly inspired by Jonathan's project because I think it opens up the pathway to gain [Indiscernible] and crowd sourcing people and they heard someone a comment imperiously effectively, pens gain could be -- Jonathan's gain could be used as a simulation and a given the people play it and optimize something they're going to make what should be the optimal path for asteroid mining and you have enough people play the game an average out how the game works out. They think they did something that they had people read solve protein folding and giving them instruction and having them with 1 million people try to solve the puzzle.

We would have to work more mechanics before we are able to [Indiscernible]
[Laughter]

But it is a start.

I think we have two very different directions here. One is to share the scientific data to allow people to data mine and to do scientific checks is one direction and the other direction, to use the data and visualize the data so everyone who has a basic interest in astronomy understand what is going on. It's a very different direction and different approach. The two directions could learn from each other because with demassification, there is scientific work and you create awareness for the problem of asteroids and everything connected with them.

I think for a few years I have been working with our public outreach and I have little project that they do each time. They all 8/4 other might pocket and flip it -- April a quarter out of my pocket and they flip it back to me and I tell them if we take that same amount of mass and stick that into a shape of all bullet, in a gun and shoot something with it, then I go to jail and things happen. The point is that once you put in that analogy, it really makes the point of if you take something the size of a them and slam it into the earth at 22 at 2230 times of the speed of that bullet. It is a real cerium point.

Fortunately we are not in the situation that this is realistic scenario and but it's problematic is communicating [Indiscernible] to the general public . We all know the case when the [Indiscernible] is approaching Earth is discovered and you have a perfect chance of [Indiscernible] and get the headline on this paper. And people in the street think it will crash the earth. This is something could really use more creative approach, visualization and when we speak of improbability of what they meet. People on the street don't really understand these low probabilities. The newspapers around the story and two days later all the impact chances are gone and people on the street don't understand why [Indiscernible] will hit one day and two days later they are saying nothing is going to happen. Communicating this process that this is not an arrow, that it made but science that gets better orbits one coming in and that communication could meet from my point of you more creative approach to tell people that [Indiscernible] that they're doing but how it works. You get a low probability and you can rule out because in the past it was communication and in that field and communicating [Indiscernible] was not good to say the least.

This is Felix, it speaks to me will return run earlier, when I was a kid I would always follow the stories as they popped out and it seemed like the astronomers were often the case where under a telescope then someone would come on screen we are all going to die and the sense that I didn't know how they were gathering the data or processing and the big thing on the awareness, what data do we have and what's important in trying to communicate [Indiscernible] to normal people . From a technical standpoint, accessibility is important with accessing the data from a visual standpoint being able to look at in process but if you're a developer learn engineer, making it accessible from that standpoint I can get something we are working which is interesting. Those for me are the big things.

To Felix's point, when I was going through astronomy in high school, one of the big things that stuck out to me was base weather.com enable list of the near Earth asteroids and the measure everything in letters and all these numbers and objects in the probability, having lunar distance in my head, I said oh I get that it's the distance from the Earth to the moon and one one of the teachers was talking, they said you should check out because they said there's a .5 LV which meant the asteroid was going to pass less than half the distance. And for me that was close. I can see the moment. I think it is almost all the comparisons that you are saying, the bullet and comparisons that you make to give people context of what to expect and I think those analogies help the public and even scientists, understanding what data is coming at us.

This is an interesting dual problem, I think in a believe there is the idea of how to reformat the data in such a way that humans is design that they can inherently understand and recognize the enormity. Or the probability of something. For the distance. Then there's how do we ship the data so that computers can use it and developers can use it to develop software to manipulate and visualize and form analysis. There are often conflicting goals. There's a challenge is putting data in the right format to be used in both ways.

The thing that I'm always talking about is we have a lot of data but very little information and when someone finds our website they don't care about the data they want information and the comparison I make is with the weatherman, that one was lost -- wind velocity and temperature and everything, when you turn on the weather Channel you don't want to know all the data, you just want to know is it going to be hot on rain. That is a service that is were not quite providing. We have a flyby list on the main page finally so people can see what asteroids are flyby and we have the distance. And there is really not that much more. We need to take all this data and somehow the subject that it is adjustable in understandable that you need -- don't need to be assigned it to understand it. It's not on making people smarter and getting them together, we should be able to provide this information.

At the same time you don't want to distill it to the point it's not useful for the Sun SPARC conversation and this Monday I was actually at a meeting integrating [Indiscernible] and were talk about the amount of information in a disaster and data, you get tons and tons and the question is how do you take that data and make it into relevant information. Not making it just digestible but making it the conversation and making it relevant and not just baby -- babying it. But making the data interesting and accessible and cool. I would love to see the analysis of the weather, I think it would be great to have a countdown clock and a distance countdown for wherever the closest or next passing object would be and that would give people a sense of this is an event. -- An event -- intimate.

Â¬To seven working on the information everyday you generate [Indiscernible] because you've done so many as of the data and you learned from going down all the rebels from digging through this him a what is important and what is not and one thing that is often the sent, not just when you're communicating the public but [Indiscernible] people get

deeply locked in the detail they forget it developed, all the information [Indiscernible - heavy accent]

-- When you're not running into them everyday it's hard to get a grasp on when they are meaningful and when they're not. They may or may not [Indiscernible] [Indiscernible - echoing]

[No Audio]

-- When you hear about asteroid mining it's actual [Indiscernible - heavy accent]

There is a point earlier I like about how hard it is to understand probability. I'm reminded of a something that I appreciate it when the media was talking about the radiation levels from [Indiscernible] the people are being exposed to . I can't remember what organization it was that they put out a big document and basically a poster where it compared how many bananas you need to eat to be exposed to different levels of things that were common radioactive sources in your life like a chess x-ray or -- test x-ray or [No Audio]

[Indiscernible] is very unlikely to get [Indiscernible] asteroids but if we do then it can be highly potential to kill more people than a tornado or hurricane or [Indiscernible] and were not really equipped mentally [Indiscernible] probability [Indiscernible]

-- It is and I agree it's difficult to convey the numbers and what they mean and I wish we had an equivalent that we could use if anyone comes up with a non-equivalent that would be great.

I'm curious if there is because managers a great one, does anyone have -- because the banana is a great one, it is catastrophic but will probability. I would love to know if anyone has come across a great way of visualizing that or metaphorically explaining it. I think it is one of the first ups to step out into the broader community to not be scaremongering but communicating clearly with the actual situation this. -- What the situation is.

In college I was assisted with [Indiscernible] and physical impacts and one of the things that struck me from that report was the comparison of you are more likely to die as a result from and asteroid [Indiscernible] then they plane crash. They don't necessarily think about asteroids but it said something about the safety of airplanes but also the tremendous power of what would happen within asteroid impact.

I think also we need to consider not just the larger impact but the smaller impacts. [Indiscernible] evidence that have taken place that are going to take place on a more regular basis and more predominant and have -- happen more often.

I think you bring up a valid point about changing the conversation, once again I was in the disaster thing on Monday and one thing that came out was usually when a disaster happens you get to sites, you get everything will be okay or you get we are all going to die and the thing that comes out and resonated with me was the statement that were not going to die and it's not okay. Even with asteroids whether one does or does not hit us at the same conversation as it's probably not going to be and we probably will get hit by something at some point in whatever time scale we look at. There are steps we can take to say it will be okay because we thought about it and we have the tools to react to it versus reacting after it happened. It is changing that fear of were not going to all day but it might not be okay and we will take steps to figure it out.

A great way to possibly explore developing more metaphors and visualization that are a variety beyond the scaremongering thing would be in our [Indiscernible] that I have seen situations where most recently in New York an event where they paired a technical expert with an artistic expert and again start with data and get the technical person to explain something to the artist in the first half of it in the second half the artist is rendering something but art is a great tool and one that we don't use enough. For someone to make a rendition here, the relative size and here's comparison and [Indiscernible] as big as the enterprise as the asteroid. That's the kind of thing that will compel people, artistic expression.

[Indiscernible - heavy accent] if you were to look at the start Margaret crushing in 2008 that the case where everything taking on the normal [Indiscernible] then apparently stream error but then one OS -- one event like the fallout [Indiscernible] was bad . In giving [Indiscernible] we have a clear reset memory and take that as low risk but high-impact combination seriously. We might possibly shot ourselves in the foot
[Indiscernible - heavy accent] because we already had some discussion and on my feel where we have the whole question about [Indiscernible] and the probability of that and that is a small probability would look really catastrophic ending. [Indiscernible - heavy accent] the reason for the low probability is different. It's a very small chance
[Indiscernible] badly wrong or Mac --.

It's two very different probabilities but two things are rare -- both rare. It is a hard one to sample.

[Indiscernible - multiple speakers]

Like John said, it happened in the past and we had [Indiscernible] and we know it is going to happen, how big is it going to be, where or when it's going to fall most likely in the ocean. But we do know it's going to happen. The question is one. Again I don't want to be [Indiscernible] but I think it's useful we are having these conversations and we have the capability to do so just like people in San Francisco. They know it's going to happen, the next earthquake and they don't think we should be called [Indiscernible] to

bring up this conversation and talking about it.

I think it is done in a responsible way and one of the things that is pulling out for me in this conversation is the significant challenges of communicating risk, managing probability, one with a population that is not necessarily that scientific the astute. To start to explore whether it is our pack upon or turning the data into a visual means that makes it easier for people to digest so that it is not fear monitoring but rather what we're doing and explaining the story in a way that the audience we are reaching for can get to. That is the other thing, we talked early on about to pass with communicating to the general public versus communicating to pay potentially more scientific group and the last session was about bringing amateurs in and how do we make it easier for them to contribute. That is a different problem than trying to make it to the general public, they should care about this. I don't think that they are two mutually exclusive activities and in fact I think they should ultimately be woven together and can inform one another. I want to potentially pivot and ask this group if you can think about or looked to examples of data projects that you have been a part of and look to as being successful. Maybe a best in class from your perspective, not necessarily having to do this probability of low risk for low probably, probability but high risk and a single point to address in a way that we can be generative in how we might move forward. May be too broad of a question. I see grumpy faces.

I can start from a UX project point of view, I go back to a project I did a year ago for a company and it was forgetting -- getting people to understand their usage. It was a wall plug that plugs into your eyelid and it's a start appear in San Francisco and we were E users and designing up for the blog -- designing an app for this blog and there were questions that came out of the user testing which was, I want to see the vampire energy and see how much energy is being used per day. Even for something as simple as a light, which many of you know does not actually use a lot of your total energy correct. We developed a way to visualize how you can see all devices that were connected through all plugs in your house and I think what stuck with me through the project was interviews of people saying I just want to know. I think with this project, if there is something that is coming at us or an asteroid, it is less going to be about what we are going to do or steps, one of the big things with the public is I just want to know because it is cool. I check space weather on a regular basis because I want to know what's going on. This is the same thing but more in the homes and what is going on and in the outlet. And they just wanted to know all the details.

I have a non-space and maybe [Indiscernible] project that came up here in New York. W and why is he contacted a sleep study and partnership with folks who are doing science and they actually got people to build [Indiscernible] devices , small quarter size [Indiscernible] that you can wrap in a sock and tie around your wrist and it would do a sleep study and track your sleep and I think they got about 5000 people to take part. That to me is inspiring and there were many people who were willing to the lease become -- come from the community that were providing reeler measurements but people who were interested. They had a state and wanted to know how is my sleep having -- how is my sleep pattern. And it was science experimentation from that perspective, it was a great success I believe and demonstrate how far people are willing to go to put form

something, scientific activity as one they have level of interest.

I would say the data mission project that I worked on have the most affect, and other once where you give the user the ability to play with the data and asked questions that you asked when you're trying to learn. A lot of times we are doing science all you're going to do is [Indiscernible] what would show the final result. [Indiscernible - heavy accent] I don't believe you because are so much under [Indiscernible] and raises some of the questions that have to trust that you answer those when you got to the conclusion. I have all the same questions. Instead of being able to give that refine the results you offer it and ability to ask those questions. And it gives you [Indiscernible] here is the top level result [Indiscernible] and the endpoint but if you want to dig in here is the way you can ask the next obvious question and start developing [Indiscernible] by being able to ask those things in order . This simple as [Indiscernible] and effectively [Indiscernible] .
[Indiscernible - heavy accent]

A follow-up to that question is, to JosÃ© that he doesn't want to be descriptive to minor planet data. Are you working in partnership with people to figure out what they want from the data, are you dig into, you build a game and what is the process you go through to enable the conversion obscure data set or message or story to get it into a place that is even beginning to be digestible by people and, number two flexible enough so you can build upon that not -- now that you're getting people engaged? My assumption is the average citizen that is not an astronomer at all, does not understand the situation. There furry removed from a data set and I would assume there are steps between that dataset and then individual that as a designer, user interface or experience, that you need to go through to enable that conversation even to begin. Other thoughts about that?

Felix can speak to this as well but you talk to your users and the whole swath of people that will be digesting this data. The real nugget with that is it will come from talking to not just the total, I don't know anything about asteroids to the dialed in citizens who know everything, you need that range of who will view the data and what other questions that they're asking about. We can sit here all day and come up with, I think people will be interested in this on that but the real meat will be actually asking people, if you were to log on to a site about asteroids that had a bunch of data in it, would you want to see and want to know?

I would talk to people.

It is understanding the system the people out there and what they are interested in. I did an interesting project, it was home energy management and I spent time in people's houses trying to understand what incentive, and what energy-saving the activities and people have blind spots. They list of 10 or 20 things when you walk in the house that they want to do and meanwhile the plasma screen is on a background in the dryers going and they would pull out a CFO light bulbs. That it taught us as a team that the company we are working with, the unit incentive is really small and people who are like us who are moving the needle, it might feel insignificant but for people who are not in the space is

actually quite significant an impact oh. -- Impeccable. I think I'm curious how to apply [Indiscernible] and what that roadmap looks like .

Never good when silence follows a little thing like that.

It so heavy I am digesting.

The NPC, collecting data that not providing information. They think that is the point we should try to transform the data we have to read information people understand because we mentioned space weather and of course you can see on the space weather webpage, the flood by data but it is still more data than information. Because when people get the data for the asteroid is possible, twice the letter distance, most of the people who call up the page don't get any idea what that means. It is so far from the distance that we deal with, it's still that kind of data, is far away from the weather forecast that everyone understands.

I want to follow that up and asked Gary -- and asked Gary, you done a wonderful job with being very protective as an astronomer and other things when you are out talking to people about your work that you think would be useful in terms of communicating what you do? We have a group of really phenomenal design folks and it might be interesting to hear your experience as an astronomer out in the world.

I think the difficult part is translating. You have a huge amount of data available and it is just interpreting that and most people will have trouble interpreting the data or Mac I think it is difficult that needs to be done and that is to take the data and take what is available and say this is what this means and what's going to happen in these are the ways you can look at it. The problem is it's translating between the data and the conceptualization people have. A lot of people don't think we have been to the moon and the problem is first of all believability. Herbert is right, when you have headlines day after day, the earth will die with this asteroid and most people get to the idea that it is just like the weather forecast they cannot predict it. We start to lose a lot of credibility on the problem is getting across to people that we have to have long-term measurement over many months in order to nail down the asteroids the right wall to make a prediction. That is the important thing. Getting that across will be important.

You bring up a point about the way humans Inc. about time and in San Francisco we have the organization about the long now and what they try to do is get us out of this box that we think of chunks of time and basically hundreds of years. Not so much after that in the trying to get us to think in more of the thousands of years and 10,000 years and this is one of the problems that is on that scale or Mac and if we are presenting this data, time is one of those and not just a scale of the problem or scale of the asteroid, it is scale of time. They could happen in 1000 years and could and hopefully will be people on earth in 1000 years but whatever we are building, I know technology changes and we might be all viewing the Internet through our brain and 5200 years but either way the data is still there

and we and think about the problem on not only the scale of yes and asteroid can be huge and wipe out the entire earth but also happen in 10,000 years and just because that is really far away for our brains to conceive, doesn't mean it doesn't matter. There's also that sense of scale as well.

I think the problem with the 10,000 year timeline, it appeals to the grandchildren
[Indiscernible - heavy accent]

I am on your side.

While there is a wall -- low I have something to show Mike.

I love it.

That is the next that we know of then I don't think you can make of the mouse but it does [Indiscernible] in real-time .

Did you just build that?

I did it while we were chatting. No. [Laughter]

It is an app. We need help with so if anyone wants to offer help and work for free then contact me.

If it is a flyby then why are you saying an impact alert.

We are not fear mongers but we want to grab attention.

The hard part is to grab attention without producing [Indiscernible] because that is what people want.

That's another question when we have the status is are going to be any sort of means, what if some happened and what do I as the layman, what do I do and is there any sort of [Indiscernible] and is there some sort of component to the UI or out of this discussion that also saying, we have this thing that might hit us and what are we then going to do?

One of the aspects of the grand challenge, the second phrase is to know what to do about them and that is ultimately where we need to get to and a lot of ways right now we are limited to providing opportunity demonstration but absolutely the next step is if we were to find something en route, is to result -- resolve the problem.

If there is a larger system in place, there's all sorts of ideas, there is a hub the collect the data that is being presented to the public. Maybe those cool ideas with solar shields or I have seen many different all some ideas and if there was a collective way of also presenting all of those two or harnessing them in a form where people can see that, we are also thinking about the what if happening.

The problem we will run into is that we have to know what these things are made of. We have to know how they are put together and what we can do about them because knowing where we can go with it is going to be more germane than if we have something coming in and if we don't know anything about it we will try something it will not work because were not going to have the characterization. We will not know how to approach it. That will be an important factor in a place where amateurs can put in a lot of time to make sure that gets done. That is where my next step is because I'm running into a point where my limited capability, running up against a wall and there's a lot more that's going on now that the surveys are picking up, and it takes a lot of my time of just to do one or two objects and I think my served better by trying to characterize exasperation and figure out the phlebitis. If I can get enough information during a flyby to characterize this rock for next time around, we will have a good idea of what we can do with it if it gets too close.

We need people like you who [Indiscernible] to pick up the characterization and guys like you to encourage other amateurs to take this on and hopefully we can encourage other people to join the fray.

Yes it is really difficult even if you have a good immature [Indiscernible] and follow-up on these discoveries.

Can I ask a question about imagery?

Are there Wizard techniques that image enhancement that will help with what you're talking about?

You have to be careful that you don't alter what you're going for. These things are so faint. A lot of objects that I turn in our somewhere around three which are tiny. You're working in the noise in the background and in order to enhance that you need to do several things. You have to get in better hemisphere which is hard for me to move a 1500 pound scope. The other thing is a bigger scope and I can't afford one. I have limited resources and you need to do what you can with what you have. Herbs software helped me out tremendously. He has done a good job with sticking images together. -- Stacking images together. Things will start smearing in my images unless they take 10 second shots. And if I do this it will be a long time to build up images and Steckel those together in order to have enough signal and noise. The problem is your right, we are ready are maxing out as much as we can with you, we have and there could be other things we can do. I can spend a lot more time on doing calibration images and that sort of thing but realistically there is not much more improvement where we are already not. -- Already at.

It all helps but fairly minute.

Would crowd funding help to get more resources?

Yes I think that is probably a good point but I don't know much about crowd funding and frankly I spent so much of my time doing these astronomy and doing the projects that I barely have time to go out. I have to work on my own scope and I have a lot of work I have to do in order to maintain this. Just to maintain everything that I'm doing right now. It is challenging. It takes a lot and I am retired.

Perhaps they support network to help create the resource allocation.

Yes it is a problem both of having time and the money. It is the two evils. I don't have a lot of time and money so I have to do things this way. Given more resources obviously I can get more done but maybe that could be spent elsewhere also. Perhaps at another observatory and do a better job. The thing of it is, I don't want to justify what I am doing and have people send me money because I may not be able to do the best work with it.

[Indiscernible - echoing] -- [No Audio]

[Indiscernible - echoing] [Indiscernible - heavy accent]

One of the things that came out of our earlier conversation with the idea of making it easier for amateurs to be able to step into this characterization work. A way of educating people with better tools. Whether it is video or fourth that allow experts to answer questions. You have experience, thoughts, ideas around the ways in which we can make the opportunity is you for people to head down the path? The path that Gary is heading now but not only the identification but someone who has bought a big telescope and doesn't know what to do with that but would be able to access the website or some source that would enable them to understand how to participate in a meaningful way?

I will say that Brian Warner hasn't asked my website and people can go to that and start through his website. I think he has a lot of good information or Mac the problem is that these things are going away from observing and more into computer work. Prepare that's an area I have a problem with and you would all of this but I don't have a very good base for working with data. The thing that needs to be done, I have a fear of getting into this in getting bogged down with stuff that I don't know anything about and I need help with that in translating basically what I do now and translating it to something more useful and characterization. All those things have to be learned as you go and experience level that is associated with this. You don't pick this up overnight.

Some people who are astronomers and amateurs is fun to go look at stuff and observe things and the actual getting in and pressing out data and characterizations is not

necessarily what people want to do as it and immature astronomers. -- Immature astronomers amateur astronomers.

Could you make it fun?

Exactly.

I am not a user interface or expense percent or even work with data in any meaningful way. Is there a way of taking Kerry's challenge where it is hard and not a lot of fun in turning it on its head and saying, not only is it fun but I am doing meaningful work because we need this characterization data gathered.

One example is I have a background in museum design and all Museum design, but a lot of them, not all, it's tricking people into learning stuff. And really your tricking children into learning. A lot of design work is, yes let's get to data faster and make processes more efficient but also how can you make data or whatever you're trying to teach someone, how you make a fun and interactive and engaging. That definitely is a big part in a big question for the challenge.

I think that is true. The big thing I think that holds me up is an used to doing astronomy that it is all fairly easy for me and if I go to switch over to characterization work than I have to learn things again. I am an old person now. The problem I run into is that I have to switch gears and it goes against my grain but I have to do it because I think that is the way things will end up. If I contribute anything it will have to be through characterization.

The problem I see in, getting the data collecting the data taking images and it's not very much fun. Even if you change using the face it's not fun. -- And we would really like to do is use data or images that are collected for some other reason then I'm not sure, and to use that image of is already here and to pick up and collect characterization data from and be able to create a decent user interface and things like this and [Indiscernible - heavy breathing]

-- Astronomy and to spend the night on the telescope and stand up the next morning and go to work is difficult. If you want to engage more people to use existing data and create and cool interface for accessing the data working with data that is already here.

I have a few hundred CDs that has been back up if anyone wants to look at them.

We are approaching the end unfortunately. We have about 5 min. or so left. I want to give an opportunity for one to have closing thoughts or ideas that this conversation might have sparked. Maybe someone wants to run with Gary's data and see what they can come up with.

John,

-- I will go to you first.

[Indiscernible - echoing] [Indiscernible - heavy accent]

Thank you.

I will jump over to her. -- Herb.

I don't see the path that we would need to go to transform the information to the [Indiscernible] but everyone understands . This is the Unseld question that remains for me an interesting thing because in weather forecast someone collects the data but the common user for the common TV viewer sees the weather forecast never gets in touch with the information that is collected but for once he is it's going to rain tomorrow the sons not going to shine and we need something like easy symbols to forecast the coalition probably or in general the knowledge that we have about you-- NEO space and I think that would be a difficult task to find [Indiscernible] and brings the huge amount of information that is collected to a single icon maybe?

Thank you.

Gary.

You never say final thought around someone my age. I run into something like observing career and I have to make that transition but the transition is foremost on my mind about how to go about doing that. We will see how that works out. I will get there eventually but it may take time.

Thank you. Felix.

First of all this has been great but I don't know if you use that app way of the Google has, if you see an accident, you can fill in and you have all these people driving on the road and they don't know each other but they're all going in the same direction generally then they have this, go to make that travel easier and more transparent and more accurate. It's ironic that we are on this rock hurtling through space and we don't have the same feeling towards asteroids. Potentially I'm pretty optimistic there has to be a way to make like atmosphere community around this challenge and I'm looking forward to doing work with you to see what that looks like.

Mike.

I think we are on the same page and two ago, we have to enable community, the three people that live in Gary's area, who are data pedal -- people and people who want to pick up astrometric. They are there. We need a way to find it communicate and connect with them using things like [Indiscernible] or other types of collaborative tools. We need to put the infrastructure in place and let people edit. -- At it. They will find it. How can we get mine craft to take part like this. Then maybe we can get people to build asteroids in mine craft, there is a bunch of ready-made community -- ready-made communities we can tap into and like John said, getting the diverse people with difference of the backgrounds and skill set and we'll have the shared common goal and we can absolutely make this happen.

Thank you. JosÃ©.

We haven't had a solution of how were going to transform the data and information. And I wasn't experience -- expect to hear solutions don't feel bad about it. We are asking right questions and I heard great comments and ideas coming out in this one and a half hour meeting and some of you parties footprint and hopefully those that [Indiscernible] and it's not a simple problem, it's multi-Tran1 and I don't think there's an one person who has the skills and it could be a community effort. It will start with us I think but we need to use those and we should be thinking of this as the public being users. And I don't think [Indiscernible] is over and we can but we need to do that all these things and get the creative juices flowing and were making steps in the right direction. Thank you everyone for participating in this and Gary want to say that you never too old to do characterization.

[Laughter]

I don't know if Brian is listening.

Amelia.

Is a you echoed what I was going to say but we do need to talk to the users and we need to understand there is a big divide of the everyday person who is curious and everyone all the way up to the Citizen scientist or the scientist that are going to know the how big is it and what materials is made of and they're summoning questions and I feel like we don't, we are just touching on what data we want to show entering into real digestible information. We can turn it into just one icon and the one whether I can't, the son of the class and I think it is definitely distilled into that and a lot of different levels and drilling down into the information that I think people will want to do. They would to see all the way deep into described as.

Thank you everyone, it has been a juicy conversation and I appreciate you taking the time

to join us. I do hope it not the end that it's an opportunity for us to continue this conversation whether it is in the wiki or figure out other ways to follow-up or Mac we have a wiki --.

We have a wiki that is active in a continue to continue the conversation and think the folks who tuned in. There was active conversation in the chat box and we couldn't get to the questions but they seem to be getting answered as well. Thank you to the Palace for doing that. -- Panelists for doing that. I invite you to tune in tomorrow, we will have Dave Morrison and maybe we -- Ricky you can bring that slide up or tomorrow. We will start at noon Eastern time with a 60 min. talk about what makes a grand challenge rant and moving into a maker conversation at 130 Eastern time and wrap up the series with the next generation engagement which is aligned with a lot of what we were talking. Thank you for everyone who participated and hope to see you tomorrow. Have a great night.

Goodbye.

[Event concluded]